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Artificial Intelligence as Law
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Bart Verheij

[Title slide]
It is my pleasure to speak to you today on Artificial Intelligence and Law, a topic that I have already loved for so long---and I guess many of you too---and that today is in the center of attention.

[Nieuwmarkt 1812]
It is not a new thing that technological innovation in the law has attracted a lot of attention. Here you see an innovation brought to us by the French 18th century freemason Joseph-Ignace Guillotin: the guillotine. This is a picture of its first use in the Netherlands, in Amsterdam, at the Nieuwmarkt. The guillotine was thought of as a *humane* technology, since the machine guaranteed an instant and painless death.

[Meppeler drunk driver, Dutch]
And here a contemporary technological innovation that attracts a lot of attention, a self-driving car that can follow basic traffic rules by itself, so in that sense is an example of normware, an artificial system with embedded norms.

[Meppeler drunk driver, English]
Here the news article in translation, *automatic* translation by the way. The story is that a drunk driver in Meppel in my province Drenthe in the Netherlands was driving his self-driving car. Well, he was riding his car, as the police discovered that he was tailing a truck, while sleeping behind the wheel, his car in autopilot mode. His driver's licence has been withdrawn.

And indeed technological innovation in AI is spectacular, think only of this automatic translation, not perfect, but enough for understanding what is going on.

Innovation in AI is going so fast that many people have become very enthusiastic about what is possible.

[Estonia]
Here a news item on Estonia planning to use AI for automatic decision making in the law.

[Futurama]
It brings back the old fears for robot judges, as here depicted in a cartoon show.

[Loi de reforme pour la justice, art 33]
In contrast here how legal data enters the legal system in France where it is since very recently no longer allowed to use data to evaluate or predict the behavior of individual judges.

The fears are real, as the fake news and privacy disasters that are happening show.

[Data diet]
Even the big tech companies are considering significant changes, such as a data diet. But no one knows whether that is because of a concern for the people's privacy or out of fear for more regulation hurting their market dominance.

[China]
Anyway, in China privacy is thought of very differently. Here you see an automatically identified car of which it is automatically decided that it is breaching traffic law---see the red box around it. And indeed with both a car and pedestrians on the zebra crossing something is going wrong.

[Wees braaf]
Just this weekend my newspaper reported about how the Chinese public thinks of their social scoring system, here described under the header `Be good, you'll score points'. It seems that the Chinese emphasises the advantages of the scoring system, as a tool against crimes and misbehavior.

[Manifesto]
Against this background of the benefits and risks of contemporary AI, the AI community in the Netherlands has presented a Manifesto emphasising what is needed: an AI that is aligned with human values and society. Here key fields of research in AI are listed in rows and in columns three key challenges are shown:
first AI should be social, and should allow for sensible interaction with humans,
second AI should be explainable, which means that black box algorithms trained on data should be made transparent by providing justifying explanations, and
third AI should be responsible, in particular AI should be guided by the rules, norms, laws of society.

[CLAIRE]
Also elsewhere there is more and more awareness of the need for a good, humane AI. Here you see a slide created by the CLAIRE confederation of laboratories for AI research in Europe. Its slogan is
Excellence across all of AI
For all of Europe
With a Human-Centered Focus.
In other words, this emerging network advertises a strong European AI with social, explainable, responsible AI at its core.

[AI&Law already does that]
And now a key point for today: AI&Law has been doing this all along. Since its primary institutions ICAIL (started in 1987), JURIX (started in 1988) and journal AI&Law (in 1992), we have been working on good AI.

In other words, AI&Law has worked on the design of socially aware explainable responsible AI for decades already.

[AI as Law]
One can say that what is needed in AI is to do AI as we do law. But before explaining how that could go let us look a bit at the current state of legal technology, for things are very different when compared to the start of the field of AI & Law.

792 words, 6 mins

[Overheid.nl]
For one thing, all branches of government now use legal technology to make its information accessible for the public and to provide services as directly and easily as possible. Here overheid.nl which provides access to laws, regulations and treaties valid in the Netherlands.

[OM fine base]
Here a web site by the Dutch public prosecution, providing a knowledge-based system that gives access to fines and punishments in all kinds of offenses. For your ease of understanding, here again an automatically translated page is shown, where you can see what happens when the police catch you with an amount of marihuana between 5 and 30 grams. In the Netherlands, you'll pay 75 euros and there is a note: also the drugs will be taken away from you.

[Rechtspraak.nl]
All branches of government are present, as this page shows that gives access to information about the Dutch judicial system, including access to many decisions.

[Belastingdienst]
An especially good example of successful legal technology is provided by the government's income tax services. Here you see its page, automatically translated. In the Netherlands, filling out your annual tax form has become very simple. The software is good, it is easy to use, and best of all: in these days of big interconnected data much of what you need to fill in is already fillled in for you. Your salary, bank

accounts, savings, mortgage interest paid, the value of your house, it is all already there when you log in. In certain cases the tool even leaves room for some mild tax evasion---or tax optimisation if you like---since by playing with some settings a married couple can make sure that one partner has to pay just below the minimal amount that will in fact be collected, ---which can save you about 40 euros.

One might think that such legal tech systems are now normal, but that is far from true. Many countries struggle with developing proper legal tech at the government level. One issue is that the design of complex systems is notoriously hard, and this is already true without very advanced AI.

[Failure]
Also the Netherlands has had its striking failures. A scary example is the IT project to streamline the IT support of population registers. One would say a doable project, just databases with names, birthdates, marriages, addresses and the like. The project was a complete failure. After burning 90 million euros, the responsible minister---by the way earlier in his career a well-recognized scientist---had to pull the plug. Today all local governments are still using their own systems.

[Codex list]
Still legal tech is booming, and focuses on many different styles of work. Here you see the classification used by the techindex maintained by the CodeX center for legal informatics at Stanford university. It currently lists more than a 1000 legal tech oriented companies.

[Projection]
And on the internet I found this promising graph about how the market for legal technology will develop. Now it is worth already a couple of 100s of millions of dollars, but in a few years time that will have risen to 1.2 billion dollars---according to this prediction. I leave it to you to assess what such a prediction really means, but we can be curious and hopeful while following how the market will actually develop.

***1351 words, 11 minutes

[Is it AI?]
So legal tech clearly exists, in fact is widespread. But is it AI, in the sense that we speak of AI at academic conferences? Most of it not really. Most of what we see that is successful in legal tech is not really AI. But there are examples.

[Tax]
I don't know about you, but I consider the tax system I just showed you to be a proper AI system. It has expert knowledge of tax law and it applies that legal expertise to your specific situation. True, this is largely good old-fashioned AI already understood in the 1970s, but by its access to relevant databases of the interconnected-big-data kind, it certainly has a modern twist. One could even say that the system is grounded in real world data, and is hence an example of situated AI, in the way that the term was used in the 1990s (and perhaps before). But also this is clearly not an adaptive machine learning AI system, as is today expected of AI.

[Hard]
The reason why much of the successful legal tech is not really AI is simple. AI & Law is hard, very hard. In part this explains why many of us are here in this room. We are brave, we like the hard problems. In AI&Law they cannot be evaded.

[Nederland ontwapent]
Let us look at an example of real law. We go back to the year when I was born when pacifism was still a relevant political attitude. In that year the Dutch Supreme court decided that the Inscription 'The Netherlands disarm', mounted on a tower was not an offense. The court admitted that indeed the sign could be considered a violation of Article 1 of the landscape management regulation of the province of North Holland, but the court decided that that regulation lacked binding power by a conflict with the freedom of speech, as codified in article 7 of the Dutch constitution.

An example of a hard case. This outcome and its reasoning could not really be predicted, which is one reason why this example is still taught in law schools.

[Hurdles]
The example can be used to illustrate some of the tough hurdles to the development of AI&Law as they have been recognized from the start. Here you see a list used by Edwina Rissland when reviewing Anne Gardner's pioneering book `An AI approach to legal reasoning', a revision of her 1984 Stanford dissertation.

I am happy that both are here in this room today.

The first hurdle is that legal reasoning is rule-guided, rather than rule-governed. In the example, indeed both the provincial regulation and the constitution were only guiding, not governing. Their conflict had to be resolved. A wise judge was needed.

Second, legal terms are open textured. In the example it is quite a stretch to interpret a sign on a tower as an example of speech in the sense of freedom of speech, but that is what the court here did. It is the old puzzle of legally qualifying the facts, not at all an easy business, also not for humans. With my background in mathematics, I found legal qualification to be a surprisingly and unpleasantly underspecified problem when I took law school exams during my first years as assistant professor in legal informatics in Maastricht, back in the 1990s. Today computers also still would have a very hard time handling open texture.

Third, legal questions can have more than one answer, but a reasonable and timely answer must be given. I have not checked how quickly the supreme court made its decision, probably not very quickly, but the case was settled. The conflict was resolved. A solution that had not yet been there, had been created, constructed. The decision changed a small part of the world.

And fourth and finally the answers to legal questions can change over time. In the example I am not sure about today's law in this respect, in fact it is my guess that freedom of speech is still interpreted as broadly as here, and I would not be surprised when it is now interpreted even broader. But society definitely has changed since the late 1960s, and what I would be surprised about is when I would today see such a sign in the public environment.

***2076/17

[Subsumption]
One way of looking at the hurdles is by saying that the subsumption model is false. According to the subsumption model of law there is a set of laws, thought of as rules, there are some facts,---and you arrive at the legal answers, the legal consequences by applying the rules to the facts. The case facts are subsumed under the rules, providing the legal solution to the case. It is often associated with Montesquieu's phrase of the judge as a `bouche de la loi', the mouth of the law, according to which a judge is just the one who makes the law speak.

All hurdles just mentioned show that this perspective cannot be true.

Rules are only guiding, terms are open-textured, there can be more answers, and things can change.

[Theory construction]
Hence an alternative perspective on what happens when a case is decided. Legal decision making is a process of constructing and testing a theory, a series of hypotheses that are gradually developed and tested in a critical discussion. The picture suggests an initial version of the facts, an initial version of the relevant rules, and an initial version of the legal conclusions. Gradually the initial hypothesis is adapted. Think of what happens in a court proceedings, and in what in the Netherlands is called the `raadkamer', the internal discussion among judges, where after a careful constructive critical discussion---if the judges get the time for that of course---finally a tried and tested perspective on the case is arrived at, showing the final legal conclusions subsuming the final facts under the final rules. This is the picture I used in the 2003 AI&Law special issue of the AI journal, edited by Edwina Rissland, Kevin Ashley, and Ronald Loui, two of them here in this room. And here is a later version with Floris Bex, emphasising that also the perspective on the evidence and how it supports the facts is gradually constructed. In our field, the idea of theory constuction in the law has for instance been emphasised by Thorne McCarty, Carole Hafner and Tom Gordon.

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[AI as law]
Today's claim is that good AI requires a different way of doing AI, a way that we in the field of AI&Law have been doing all along, namely doing AI in a way that meets the requirements of the law, in fact in a way that models how things are done in the law. Let us discuss this perspective a bit further.

[AI metaphors]
Because there can be many metaphors on what AI is and how it should be done. Here you see a few.

AI as mathematics, where the focus is on formal systems;
AI as technology, where the focus is on the art of system design;
AI as psychology, where the focus is on intelligent minds;
AI as sociology, where the focus is on societies of agents.

And then AI as law to which we return in a minute.

[More on AI metaphors]
In AI as mathematics, one can think of the logical and probabilistic foundations of AI, indeed since the start and still now of core importance. It is said that the namegiver of the field of AI John McCarty thought of the foundations of AI as an instance of logic, and logic alone. And today some consider AI to be a kind of statistics 2.0 or 3.0.

In AI as technology, one can think of meticulously crafted rule-based expert systems or on machine learning algorithms evaluated on large carefully labeled data sets. In AI as technology, AI applications and AI research meet most directly.

In AI as psychology, one can think of the modeling of human brains as in cognitive modeling, or of the smart human-like algorithms that are sometimes referred to as cognitive computing.

In AI as sociology, one can think of multi-agent systems simulating a society and of autonomous robots that fly in flocks.

[Toulmin]
Perhaps you have recognized the list of metaphors as the ones used by Stephen Toulmin in his 1958 book when he discussed what he thought of as a crisis in the logical analysis of human reasoning. He argued that the classical formal logic then fashionable were too irrelevant for what reasoning actually was, and he arrived at a perspective of logic as law. What he meant was that counterargument must be considered, that rules warranting argumentative steps are material---and not only formal---, that these rules are backed by factual circumstances, that conclusions are often qualified, uncertain, presumptive, and that reasoning and argument are to be thought of as the outcome of debates among individuals and in groups.

All of these ideas have now been studied extensively, with the field of AI and law having played a significant role in the developments, and researchers like Henry Prakken, Giovanni Sartor, Tom Gordon, Trevor Bench-Capon and Katie Atkinson as prominent contributors.

[Law metaphors]
The metaphors can also be applied to the law, exposing some key ideas familar in law.

If we think of law as mathematics, the focus is on the formality of procedural rule following and of stare decisis where things are well-defined and there is little room for freedom.

In law as technology, one can think of the art of doing law in a jurisdiction with either a focus on rules, as in civil law systems, or with a focus on cases, as in common law systems.

In law as psychology, one can think of the judicial reasoning by an individual judge, and of the judicial discretion that is to some extent allowed, even wanted.

In law as sociology, the role of critical discussion springs to mind, and of regulating a society in order to give order and prevent chaos.

And finally the somewhat pleonastic metaphor of law as law, but now as law in contrast with the other metaphors. I think of two specific and essential ideas in the law, namely that government is to be bound by the rule of law, and that the goal of law is to arrive at justice, thereby supporting a good society and a good life for its citizens.

Note how this list shows the hybrid balancing of different sides:

rules and cases,
regulations and decisions,
rationality and interpretation,
individual and society,
boundedness and justice.

And as we know this balancing best takes place in a constructive critical discussion.

[AI as law]
Which brings us to bottom of the list of AI metaphors. In AI as law, AI systems are to be thought of as hybrid critical discussion systems, where different hypothetical perspectives are constructed and evaluated until a good answer is found.

[Argumentation systems]
In this connection, I recently used ths diagram showing what is needed in AI, namely the much needed step we have to make towards hybrid systems that connect knowledge representation and reasoning techniques with the powers of machine learning, yesterday so eloquently discussed by

Montreal Turing award winner Yoshua Bengio. In this diagram I used the term argumentation systems. But since argumentation has a very specific sound in this community, and perhaps to some feels as a too specific, too limiting perspective, I today speak of AI as law by the development of hybrid critical discussion systems.

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[Topics in AI]
Let me continue with a discussion of core topics in AI with the AI as Law perspective in mind. My focus is on reasoning, knowledge, learning and language.

[Reasoning]
First reasoning. I then indeed think of argumentation where arguments and counterarguments meet. This is connected to the idea of defeasibility, where arguments become defeated when attacked by a stronger counterargument. Argumentation has been used to address the deep and old puzzles of inconsistency, incomplete information and uncertainty.

[Arg example]
Here is the example of the Dutch bike owner Mary whose bike is stolen. The bike is bought by John, hence both have a claim to ownership---Mary as the original owner, John as the buyer. But in this case the conflict can be resolved as John bought the bike for a the low price of 20 euros, indicating that he was not a bona fide buyer. At such a price, he could have known that the bike was stolen, hence he has

no claim to ownership as the buyer, and Mary is the owner.

[ArguMed]
It is one achievement of the field of AI&Law that the logic of argumentation is by now well understood, so well that it can be implemented in argumentation diagramming software that applies the logic of argumentation. Here you see the ArguMed software that I implemented long ago during my postdoc period in the Maastricht law school.

[Abstract argumentation 1995]
It implements argumentation semantics of the stable kind in the sense of Dung's abstract argumentation that was proposed some 25 years ago. A turning point and a cornerstone in today's understanding of argumentation, with many successes. It also gave new puzzles such as the lack of standardization giving rise to all kinds of detailed comparative formal studies, and more fundamentally the multiple formal semantics puzzle. Here you see the four proposed by Dung,

[Abstract argumentation 1996]
quickly thereafter extended to 6. But that was only the start because the field of computational argumentation was then still only emerging.

[Argumentation semantics 2003]
For me, it was obvious that a different approach was needed when I discovered that after combining attack and support these 11 different semantics were formally possible, but practically almost all hardly relevant. No lawyer has to think about

whether the applicable argumentation semantics is the semi-stable or the stage semantics.

[Abstractness]
One puzzle in the field, here included after a discussion on the plane from Amsterdam to Montreal with Trevor and Henry. A key idea underlying the original abstract argumentation paper is that derivation-like arguments can be abstracted from, allowing to focus only on attack. Here the ovals with arguments expressing support show what is abstracted from in the abstract version at the bottom of the slide. I know that for many this idea has helped them in their work and understanding of argumentation. For me, this was---from rather early on---more a distraction than an advantage as it introduced a separate, seemingly spurious layer. In the way that Jaap Hage put it---who was then my PhD supervisor---`those cloudy formal structures of yours', and Jaap referred to the abstract diagrams in the sense of Dung, have no grounding in how lawyers think. There is no separate category of supporting arguments, in the law there are only reasons for and against conclusions that must be balanced. Those were the days when Jaap Hage was working on Reason-Based Logic and I was helping him. In a sense, my ArguMed software based on the DefLog formalism was my answer to removing that redundant intermediate layer, while sticking to the important mathematical analysis of reinstatement uncovered by Dung.

[Case models]
But as I said already from around the turn of the millenium I thought a new mathematical foundation was called for, and it took me years to arrive at something that really increased my understanding of argumentation. Here you see the core definition, but that is not for now.

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[Knowledge]
The second topic of AI to discuss is knowledge, so prominent in AI and in law. I then think of material, semi-formal argumentation schemes such as the witness testimony scheme, or the scheme for practical reasoning, as for instance collected in the nice volume by Doug Walton, Chris Reed and Fabrizio Macagno.

I also think of norms, in our community often studied with a Hohfeldian perspective on rights and obligations as a background. And then there are the ontologies that can capture large amounts of knowledge in a systematic way.

[Facts in the law]
One lesson that I have taken home from working in the domain of law---and again don't forget that I started in the field of mathematics where things are thought of as neat and clean---one lesson is that in the world of law things are always more complex than you think. One could say that it is the business of law to find the exactly right level of complexity, and that is often just a bit more complex than one's initial idea.

And if things are not yet complex now, they can become tomorrow. Remember the dynamics of theory construction that we saw earlier.

Here you see at the top left how in the law traditionally different categories of juristic facts are distinguished. Here juristic facts are the kind of facts that are legally relevant, that have legal consequences. They come in two kinds: acts and bare juristic facts, where the latter are intentionless events such as being born. And acts are distinguished in on the one hand juristic acts aimed at a legal consequence such as contracting, and on the other factual acts, where although there is no legal intention, still there are legal consequences. Here the primary example is that of unlawful acts as discussed in tort law. I am still happy that I learnt this categorization of juristic facts in the Maastricht law school, as it has relevantly expanded my understanding of how things work in the world. And of how things should be done in AI. Definitely not purely logical or purely statistical, definitely with much attention for the specifics of a situation.

At the bottom right you see another categorization, prepared with Jaap Hage, that shows how we then thought of the core categories of things, or `individuals' that should be distinguished when analyzing the law: states of affairs, events rules, other individuals, and then the subcategories of event occurrences, rule validities and other states of affairs. And although such a categorization does have a hint of the baroqueness of Jorge Luis Borges'

animal taxonomy that included those animals that belong to the emperor, mermaids and innumerable animals,

[Signing]

the abstract core ontology helped us to analyze the relations between events, rules and states of affairs that play a role when signing a contract. Indeed at first sight a complex picture but when you see it it provides a transparent perspective. For now the only thing to note is that at the top row there is the physical act of signing---say when the pen is going over the paper to sign---and this physical act counts as engaging in a contractual bond (shown in the second row), which implies the undertaking of an obligation (third row), which in turn leads to a duty to perform an action (at the bottom row). Not a simple picture, but as said, in the law things are often more complex than expected, and typically for good, pragmatic reasons.

[Commonsense]
The core puzzle for our field and for AI generally that I would like to mention is that of commonsense knowledge. This remains an essential puzzle, also in these days of big data; also in these days of cognitive computing. Machines simply don't have commonsense knowledge that is nearly good enough. Here a knowledgeable report in the communications of the ACM reporting that progress has been slow. It goes back to 2015, but please do not believe it when it is suggested that things are very different today.

The commonsense knowledge problem remains a relevant and important research challenge indeed and I hope to see more of the big knowledge needed for serious AI and Law in the future. Only brave people have the chance to make real progress here, like the people in this room.

[Scenario schemes]
One example of what I think is an as yet underestimated cornerstone of commonsense knowledge is the role of globally coherent knowledge structures---such as the scenarios and cases we encounter in the law. Here a slide by our current program chair Floris Bex who in his dissertation took relevant steps to investigate scenario schemes and how they are hierarchically related, here in the context of murder stories. Our field would benefit from more work like this, that goes back to the frames and scripts studied by people such as Roger Schank and Marvin Minsky.

[Case model construction]
And here you my current favorite kind of knowledge representation, using the case models I showed you the formal definition of. Here you see represented how an appellate court gradually constructs its hypotheses about a murder case on the basis of the evidence, gradually testing and selecting which scenario of what has happened to believe or not.

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[Learning]
Then learning about which we already heard so much yesterday. It is the domain of statistical analysis that shows that certain judges are more prone to supporting democrat positions than others, and that as we saw no longer is allowed in France. It is the domain of open data, that allows public access to legal sources and in which community members such as Monica Palmirani and Enrico Francesconi have been very active. And finally it is the realm of neural networks, back in the days called perceptrons, now referred to as deep learning.

The core theme to be discussed here is the issue of how learning and the justification of outcomes go together, using a contemporary term: how to arrive at an explainable AI, an explainable machine learning. We have heard it discussed at all career levels, by young PhD students and by a Turing award winner.

[Prediction]
The issue can be illustrated by this mock prediction machine for Dutch criminal courts. It has a button that you can push,

[P2]
that once you push it always gives the outcome that the suspect is guilty as charged. And thinking of Jack Conrad's relevant emphasis that systems must be evaluated, this system has indeed been validated ...

[P3]
... by the Dutch central bureau of statistics, that has the data that shows that this prediction machine is correct in 91 out of a 100 cases.

[P4]
Here you see a graph of the validating data. It shows that my prediction machine has become a bit less accurate in recent years, presumably by changes in society, perhaps in part caused by the attention in the Netherlands for so-called dubious cases, or miscarriages of justice, which may have made judges a little more reluctant to decide for guilt. But still: 91% for this very simple machine is quite good. And as you know says very little about how to decide for guilt or not.

[Judicial prediction]
How hard judicial prediction really is, also when using serious machine learning techniques, is shown by these examples. Katz, Bommarito and Blackman showed in 2017 that their US supreme court prediction machine could achieve a 70% accuracy. A mild improvement over the baseline of the historical majority outcome (to always affirm a previous decision) which is 60%, and even milder over the 10 year majority outcome which is 67%. The system based its predictions on features such as judge identity, month, court of origin and issue, so modest results are not surprising.

In another study Aletras and colleagues studied European Court of Human Rights cases. They used n-grams and topics as the starting point of their training, and used a prepared dataset to make a cleaner baseline of 50% accuracy by random guessing. They reached 79% accuracy using the whole text, and noted that by only using the part where the factual circumstances are described already an accuracy of 73% is reached.

Naively taking the ratios of 70 over 60 and of 79 over 50, one sees that factors of 1.2 and of 1.6 improvement are relevant research outcomes, but practically modest. And more importantly these systems only focus on outcome, without saying anything about how to arrive at an outcome, about for which reasons an outcome is warranted or not.

[Neural networks]
And indeed and as said before learning is hard, especially in the domain of law. I am still a fan of an old paper by Trevor on neural networks and open texture. In an artficially constructed example about welfare benefits, he included different kinds of constraints: boolean, categorical, numeric. For instance, women were allowed the benefit after 60, and men after 65. Trevor found that after training, the neural network could achieve a high overall performance, but with somewhat surprising underlying rationales. On the left, one can see that the condition starts to be relevant long before the ages of 60 and 65 and that the difference in gender is something like 15 years instead of 5.

On the right, with a more focused training set using cases with only single failing conditions, the relevance started a bit later, but still too early, while the gender difference now indeed was 5 years.

[Cases and rules]
What I have placed my bets on is the kind of hybrid cases and rules systems that for us in AI&Law are normal and that have been studied by many people here already mentioned and also by Karl Branting, Marc Lauritsen, Vern Walker, Mathias Grabmair, Adam Wyner. Here you see how I now represent Dutch tort law in terms of case models on the left and in terms of rule-based arguments on the right.

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[Language]
Then language, the fourth and final topic of AI that I would like to discuss with you. Today the topic of language is closely connected to machine learning. I think of the labeling of natural language data to allow for training; I think of prediction such as by a search engine or chat application on a smartphone, and I think of argument mining, a relevant topic with strong roots in the field of AI&Law.

[IBMs Watson]
The study of natural language in AI, and in fact of AI itself, got a significant boost by IBM's Watson system that won the Jeopardy! quiz show. Here you see that Watson correctly recognizes the description of `A 2-word phrase [that] means the power to take private property for public use'. That refers to the typically legal concept of eminent domain,

where a government disowns property for public reasons, such as the construction of a highway or windmill park. The legal concept scores 98%, but also `electric company' and `capitalist economy' are considered with 9% and 5% scores. Apparently Watson sees some kind of overlap between the legal concept, electric companies and capitalist economy, since 98+9+5 is more than a 100 percent.

[IBM's debater]
And IBM continued, as Watson was used as the basis for its debating technologies. Here you see a screenshot of a 2014 online video where the system is considering the sale of violent video games to minors. The video shows that the system finds reasons for and against banning the sale of such games to minors, for instance that most children who play violent games do not have problems, but that violent video games can increase children's aggression. The video remains impressive, and for the field of computational argumentation that I am a part of it was somewhat discomforting that the researchers behind this system were then outsiders to the field.

The success of these natural language systems leads one to think about why they can do what they do. Do they really have an understanding of a complex sentence describing the legal concept of eminent domain; can they really digest newspaper articles on violent video games?

These questions are especially relevant since in our field of AI&Law we have had the opportunity to follow research on argument mining from the start.

[Mochales&Moens]
An early and relevant paper is by Raquel Mochales Palau and Sien Moens, who studied argument mining in a paper at the 2009 ICAIL conference. And as already shown in that paper, it should not be considered an easy task to perform argument mining. Indeed the field has been making relevant and interesting progress, as also shown in research presented at this conference, but no one would claim the kind of natural language understanding needed for understaning legal concepts or online debates. So what then is the basis of success?

Is it simply because a big tech company can do a research investment that in academia one can only dream of? Certainly that is a part of what has been going on.

[Poor man's Watson]
But there is more to it than that as can be appreciated by a small experiment I did, this time actually an implemented online system. It is what I ironically called Poor Man's Watson, which has been programmed without much deep natural language technology, just some simple regular expression scripts using online access to the Google search engine and Wikipedia. And indeed it turns out that my simple script can also recognize the concept of eminent domain: when one types `the power to take private property for public use' the answer is `eminent domain'. The explanation for this remarkable result is that for some descriptions the correct Wikipedia ends up high in the list of pages returned by Google,

and that happens because we---the people---have been typing in good descriptions of those concepts in Wikipedia, and indeed Google can find these pages. Sometimes the results are spectacular, but also they are brittle since seemingly small, irrelevant changes can quickly break this simple system.

And for the debating technology something similar holds.

[ProCon]
Since there are web sites collecting pros and cons of societal debates. Here you see procon.org on violent video games.

[ProCon 2]
And here some of the arguments it has collected.

[Kialo]
And here Kialo where similar lists are collaboratively created.

Surely the existence of such lists typed in, in a structured way, by humans is a central basis for what debating technology can and cannot do. It is not a coincidence that when you listen carefully to the reports that the examples used in marketing concern curated lists of topics. At the same time this does not take away the bravery of IBM and how strongly it has been stimulating the field of AI by its successful demos.

[IBM's debater match]
And that also for IBM things are sometimes hard is shown by this report from last February where IBM's technology entered into a debate with a human debater, and this time lost. But who knows what the future brings.

[Charlotte]
What I believe is needed is the development of an ever closer connection between complex knowledge representations and natural language explanations, as here in work by Charlotte Vlek on explaining Bayesian Networks, which had nice connections to the work discussed by Jeroen Keppens yesterday.

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[AI as Law]
As I said I think the way to go for the field is to develop an AI that is much like the law, an AI where systems are hybrid critical discussion systems.

[AI]
For after phases of AI as mathematics, as technology, as psychology, and as sociology---all still important and relevant---, an AI as Law perspective provides fresh ideas for designing an AI that is good. And in order to build the hybrid critical discussion systems that I think are needed, lots of work is waiting in reasoning, in knowledge, in learning and in language.

[Topics]
For reasoning, the study of formal and computational argumentation remains relevant and promising, while work is needed to arrive at a formal semantics that is not only accessible for a small group of experts.

For knowledge, we need to continue working on knowledge bases large and small, and on systems with embedded norms. But I hope that some of us are also brave enough to be looking for new ways to arrive at good commonsense understanding by machines. In the law we cannot do without wise commonsense.

For learning, the integration of knowledge and data can be addressed by how in the law rules and cases are connected and influence one another. Only then the requirements of explainability and responsibility can be properly addressed.

For language, work is needed in interpretation of what is said in a text. This requires an understanding in terms of complex, detailed models of a situation, as what happens in any court of law where every word can make a relevant difference.

Lots of work to do. Lots of high mountains to conquer.

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[Oratie]
The perspective of AI as Law discussed here today can be regarded as an attempt to broaden what I said in the lecture on `Arguments for good AI' where the focus is mostly on computational argumentation. There I explain that we need a good AI that can give good answers, give good reasons for them, and make good choices.

[Argumentation systems]
I projected that in 2025 we will have arrived at a new kind of AI systems bridging knowledge and data, namely argumentation systems. Clearly and as I tried to explain today, there is still plenty of work to be done.

[Cases and rules]
There I describe that I expect that a key role will be played by work in our field on connections between rules, cases and arguments, as in this set of cases formalizing tort law on the left that formally validate the rule-based arguments on the right.

[Robot judge]
By following the path of developing AI as Law we can guard against technology that is bad for us,

[Good robot]
and that unlike the guillotine I started with is a really humane techology that directly benefits society and its citizens.

[Conclusion]

In conclusion, in these days of dreams and fears of AI and algorithms, our beloved field of AI&Law is more relevant than ever.

We can be proud that AI&Law has worked on the design of socially aware, explainable, responsible AI for decades already.

And since we in AI&Law we are used to address the hardest problems across the breadth of AI (reasoning, knowledge, learning, language),---since in fact we cannot avoid them---, our field can inspire ideas for new solutions. In particular, I discussed computational argumentation, schemes for arguments and scenarios, encoded norms, hybrid rule-case systems and computational interpretation.

We only need to look at what happens in the law. In the law, we see an artificial system that adds much value to our life. Let us work on building a legal AI that is not scary, but that genuinely contributes to a good quality of life in a just society.

I am happy and proud to be a member of this brave and smart community and I thank you for your attention.

[Final slide]

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FURTHER READING

Verheij, B. (2018). *Arguments for Good Artificial Intelligence*. Groningen: University of Groningen. Inaugural lecture. http://www.ai.rug.nl/~verheij/oratie/. details pdf